REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 13, 1995	Annual: 02/01/94 - 01/31/95

4. TITLE AND SUBTITLE
Cloud Condensation Nuclei Measurements in Shiptrails

5. FUNDING NUMBERS
G N00014-94-1-0339

6. AUTHOR(S)
James G. Hudson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Desert Research Institute
University and Community College System of Nevada
P.O. Box 60220
Reno, Nevada 89506-0220

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
800 North Quincy Street
Arlington, Virginia 22217 - 5660

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
None

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

At the end of May the CCN spectrometer and calibration equipment were transported to Monterey for the field project. The equipment operated successfully for most of the time on 11 of the 12 research flights. For most of the time the CCN spectrometer directly monitored the ambient CCN spectrum. Occasionally, the sample aerosol was heated to obtain particle volatility. Sometimes the aerosol was size classified to obtain the relative solubility of the CCN. During some of the in-cloud passes the CCN spectrometer monitored the residue from the cloud droplets from the counterflow virtual impactor (CVI) which allows a precise determination of the CCN that are actually within the cloud droplets.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Clouds, Aerosol, pollution	2
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std Z39-18
298-102

13 April, 1995

ANNUAL REPORT No. 1
February 1, 1994 - January 31, 1995

Cloud Condensation Nuclei Measurements in Shiptrails
(Grant N00014-94-1-0339)

Submitted to
Office of Naval Research

by

James Hudson
Principal Investigator

During this first year the primary focus was on the field project in June. To this end the CCN calibration equipment, including the 3010 CN counter, along with the volatility apparatus were mounted in a new rack for easy installation and operation. During April the investigator attended the planning meeting in Monterey and brought the equipment--two racks--to Seattle for installation on the University of Washington C-131 aircraft. The equipment was there for one week during which three test flights were made. The DRI equipment operated without problems on these flights.

At the end of May the same equipment was transported to Monterey to again be mounted on the C-131 for the field project. The equipment operated successfully for most of the time on 11 of the 12 research flights. For most of the time the CCN spectrometer directly monitored the ambient CCN spectrum. Occasionally, usually at least once per flight, the sample aerosol was heated to high temperatures in a processing tube. This yielded information about the volatility of the particles, which can be used for indirect chemical identification of the particles. Also on some of the flights the aerosol was size classified before entering the CCN spectrometer. This allowed the size of the CCN to be

determined, which yields information about the relative solubility of the CCN. This is another indirect determination of particle composition. During some of the in-cloud passes the CCN spectrometer monitored the residue from the cloud droplets. This intercomparison with the counterflow virtual impactor (CVI) of the University of Rhode Island allows a precise determination of the CCN that are actually within the cloud droplets. When this is compared with the ambient CCN and the cloud droplet distribution important clues about cloud dynamics can be obtained.

During and since the project the total CCN concentrations and the total particle concentrations have been plotted as a function of time and pressure altitude--for the soundings. The calibrations have been plotted in order to derive the complete CCN spectrum from the data. Analysis of the data is ongoing.

There were very high CCN concentrations within most of the ship plumes that were penetrated. This was highly variable depending on the distance from the ship, ambient conditions, and probably the ship power plant--operating conditions and fuel. Higher concentrations were also found within the shiptrail clouds compared with ambient clouds.